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(54) Title: HOT MELT ADHESIVE COMPOSITION, ITS COATING METHOD AND DISPOSABLES USING THE SAME

(57) Abstract

There is provided a hot-melt adhesive composition which improves the non-uniform application pattern in the form of dotted particles of the hot-melt adhesive upon the application thereof in the melt blow manner, suppresses the bouncing phenomenon, and also provides excellent adhesion with respect to the elastomer such as a natural rubber. The object is achieved by the hot-melt adhesive composition containing the following components (A) to (C): (A) a thermoplastic rubber; (B) a diene based rubber comprising at least one selected from a styrene-butadiene rubber and a styrene-isoprene rubber; and (C) a tackifier resin.

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# HOT MELT ADHESIVE COMPOSITIONS, ITS COATING METHOD AND DISPOSABLES USING THE SAME

## DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a hot melt adhesive composition which is used for a paper diaper, a sanitary napkin and so on, a method of applying the composition, and a disposable article in which the composition is used.

Generally, a disposable article represented by a paper diaper, a sanitary napkin and so on is formed by bonding substrates together which are made of a nonwoven fabric, a woven fabric, an elastomer (such as a natural rubber, a polyurethane based elastomer), a polyethylene film, paper and so on. As an adhesive for such bonding, at least one of a synthetic rubber based hot-melt adhesive and an olefin based hot-melt adhesive is used as disclosed in for example Japanese Patent Kokai Publication No. S60-158284. The synthetic rubber based hot melt adhesive includes as a base polymer, at least one of a styrene-butadiene-styrene block copolymer (SBS), a styrene-isoprene-styrene block copolymer (SIS), a styrene-ethylene-butadiene-styrene block copolymer (SEBS), a styrene-ethylene-propylene-styrene block copolymer (SEPS) and so on. The said olefin based hot melt adhesive uses as a base polymer, an α olefin based resin, an ethylene-vinyl acetate copolymer (EVA) and so on.

The said disposable article such as a paper diaper is produced by fusing the hot melt adhesive and applying it on the above-named each substrate followed by laminating them together. An application manner of the hot melt adhesive has been improved and developed with time, and also the hot melt adhesive has been developed which is suitable for the characteristics of the application equipment. Recently, the substrate made of a polyethylene film, a nonwoven fabric and so on has become thinner, so that the conventional application manner has caused problems of oozing, blocking and so on of the hot-melt adhesive. Nowadays, in order to overcome the problems, a melt blow application manner has been developed, and it is getting possible to apply the hot melt adhesive uniformly with a low weight per unit area.

However, when the above-stated synthetic rubber based hot melt adhesive is applied with the melt blow manner, the hot melt adhesive is non-uniformly applied to a substrate in a pattern which particles of the hot melt adhesive are dotted. Therefore, in a region in which the dotted particles or specks of the hot melt adhesive are present on the substrate, they are bulky, so that they penetrate another thin substrate such as a nonwoven fabric overlaid thereon when the substrates are laminated together. Thus, there occurs the blocking problem as well as a problem of portions to which the hot melt adhesive is not applied. When an olefin based hot melt adhesive is applied in the melt blow manner, a relatively uniform application pattern in the form of elongated fibers is achieve more easily than the synthetic rubber based hot melt adhesive, but there often occurs a bouncing phenomenon (a phenomenon in which the hot melt adhesive sprayed out of a nozzle of a coater apparatus solidifies before reaching a substrate so that the adhesive is bounced off the substrate surface by means of spray air). Then, it is possible to overcome the bouncing phenomenon by a manner in which a liquid component is added to the olefin based hot melt adhesive so that the solidification of the hot melt is suppressed before reaching the substrate. However, since the olefin based hot melt adhesive has extremely bad adhesion to an elastomer such as a natural rubber which is used for the paper diaper, it cannot be used to bond the elastomer.

The present invention has been made considering the above situations, and thus the objects of the present invention are to provide a hot melt adhesive composition which improves the non-uniform application pattern in the form of the dotted particles of the hot melt adhesive upon the application thereof in the melt blow manner, which suppresses the bouncing phenomenon, and which provides the excellent adhesion with respect to the elastomer such as a natural rubber, and also to provide a method of applying such a hot melt adhesive composition and a disposable article in which the hot melt adhesive composition is used.

The first aspect of the present invention resides in a hot melt adhesive composition comprising the following components (A) to (C), and the second aspect resides in a method of applying the hot melt adhesive composition in the melt blow

manner. Further, the third aspect of the present invention resides in a disposable article in which the above hot melt adhesive composition bonds at least two different substrates:

(A) a thermoplastic rubber;

(B) at least one diene based rubber selected from a styrene-butadiene rubber and a styrene-isoprene rubber; and

(C) a tackifier resin.

That is, the present inventors have made studies so as to obtain a hot melt adhesive composition which improves the non-uniform application pattern in the form of the dotted particles of the hot melt adhesive upon the application thereof in the melt blow manner, which suppresses the bouncing phenomenon, and which provides excellent bond with respect to the elastomer such as a natural rubber. During the studies, it hgas been found that when a thermoplastic rubber such as an SBS, and SEBS and so on I used as a main component of the hot melt adhesive composition, particles of the hot melt adhesive composition are likely to be formed upon spraying thereof in the melt blow manner because of rubbery elasticity of the thermoplastic rubber. Thus, the present inventors have come to an idea that using a specific diene based rubber together with said thermoplastic rubber would provide good results, continued their studies on the specific diene based rubbers, and finally found out that co-using a diene based rubber of at least one selected from a styrene-butadiene rubber and a styrene-isoprene rubber (component B) together with said thermoplastic rubber (component A) reduces the rubbery elasticity so that the formation of the particles is suppressed. Further, based on subsequent studies, the inventors have found that a hot melt adhesive composition in which the above tackifier resin (component C) is co-used together with said thermoplastic rubber (component A) and said specific diene based rubber (component B) improves the non-uniform application pattern in the form of the dotted particles of the hot melt adhesive upon the application thereof in the melt blow manner, suppresses the bouncing phenomenon, and provides the excellent adhesion with respect to the elastomer such as a natural rubber, so that the present inventions have been completed.

When said hot melt adhesive composition is applied in the melt blow manner, the non-uniform application pattern in the form of the dotted particles of the hot melt adhesive is further improved, and the bouncing phenomenon is more effectively suppressed.

Further, the disposable article in which said hot melt adhesive composition bonds substrates is superior in its adhesion to the conventional disposable article. Especially, when the hot melt adhesive composition is used for the paper diaper in which at least one substrates includes a member of a natural rubber, the adhesion is remarkably improved.

Then, the embodiments of the invention will be explained.

The hot melt adhesive composition according to the present invention is prepared by using the thermoplastic rubber (component A), the specific diene based rubber (component B) and the tackifier resin (component C).

As to the thermoplastic rubber (component A), there is no specific limitation as far as it is used for the conventional hot melt adhesive composition. For example, those are exemplified which includes as a main chain, the following: a styrene-butadiene-styrene block copolymer (SBS), a styrene-isoprene-styrene block copolymer (SIS), a triblock copolymer such as styrene-ethylene-butadiene-styrene block copolymer (SEBS) and so on. The above thermoplastic rubbers may be used alone or in any combination of at least two of them. Among them, the SBS and the SIS are particularly preferable because of their compatibilities with the specific diene based rubber (component B).

A content of the above thermoplastic rubber (component A) is preferably in the range between 5% and 30% by weight (hereinafter, referred to as merely "%") of the total weight of the hot melt adhesive composition, and the content in the range between 10% and 20% is particularly preferable. That is, when the content of component A is less than 5%, there may be less adhesion strength at a high temperature, and when the content is more than 30%, application operation of the adhesive composition tends to get inconvenient.

As the specific diene based rubber (component B) which is used with the thermoplastic rubber (component A), at least one of the styrene-butadiene rubber (SBR) and the styrene-isoprene rubber (SIR) is used.

A content of the above specific diene based rubber (component B) is preferably not more than 30% of the total weight of the hot melt adhesive composition, more preferably 2 to 25%, and particularly preferably 5 to 20%. That is, when the content of component B is more than 30%, there may be less adhesion strength at a high temperature.

The specific diene based rubber (component B) has a styrene content of preferably not more than 50%, more preferably in the range between 10% and 50%, and particularly preferably in the range between 13% and 46%. That is, when the styrene content is more than 50%, there may be less adhesion strength at a low temperature. Further, a viscosity of a toluene solution which contains 25% of the specific diene based rubber (component B) (25% toluene solution viscosity) is preferably not more than 80000 cps, more preferably not more than 20000 cps, and particularly preferably not more than 10000 cps. That is, when the 25% toluene solution viscosity is more than 80000 cps, the application operation of the hot melt adhesive composition tends to get inconvenient.

As the tackifier resin (component C) which is used together with the above thermoplastic rubber (component A) and the specific diene based rubber (component B) is not particularly limited as long as it is used for the conventional hot melt adhesive. For example, the following may be used: a natural rosin, a modified rosin, a hydrogenated rosin, a glycerol ester of natural rosin, a glycerol ester of a modified rosin, a pentaerythritol ester of natural rosin, a pentaerythritol ester of a modified rosin, a pentaerythritol (ester) of a hydrogenated rosin, a copolymer of a natural terpene, a three dimensional copolymer of a natural terpene, a hydrogenated derivative of a copolymer of a natural terpene, a hydrogenated derivative of a three dimensional copolymer of a natural terpene, a polyterpene resin, a phenol based modified terpene resin, a hydrogenated derivative of a phenol based modified terpene resin, an aliphatic petroleum hydrocarbon resin, a hydrogenated derivative of an aliphatic petroleum hydrocarbon resin, an aromatic petroleum hydrocarbon resin, a hydrogenated derivative of an aromatic petroleum hydrocarbon resin, a cyclic aliphatic petroleum hydrocarbon resin, a hydrogenated derivative of a cyclic aliphatic petroleum hydrocarbon resin and so on. These tackifier

resins may be used alone or in any combination of at least two of these. Among these tackifier resins (component C), the hydrogenated resins are preferable since they have no odor and good heat resistance. When the hot melt adhesive composition according to the present invention is used for the sanitary articles such as a sanitary napkin, the above tackifier resin (component C) is preferably colorless or white and has substantially no odor. It is noted that "substantially no odor" means almost no odor as indicated in a self-limitation of the Japan Hygiene Products Industry Association.

A content of the above tackifier resin (component C) is preferably in the range between 30% and 70% of the total weight of the hot melt adhesive composition, and particularly preferably between 45% and 65%. That is when the content of component C is less than 30%, the tackiness and the adhesion of the hot melt adhesive composition may be decreased, and when the content is larger than 70%, the hot melt adhesive may become brittle so that its low temperature adhesion may be adversely affected.

The hot melt adhesive composition according to the present invention may further include a plasticizer so as for example to lower a melt viscosity of the composition, to give flexibility or to adjust adhesion strength. As such a plasticizer, a plasticized oil is preferably used. For example, a paraffinic oil, a naphthenic oil and an aromatic oil are exemplified. Among them, the paraffinic oil is preferable because of its substantially odorless and colorless properties. A content of the above plasticizer is preferably not more than 30% of the total weight of the hot melt adhesive composition, and particularly preferably not more than 25%.

It is noted that the hot melt adhesive composition according to the present invention optionally includes in addition to the components (A) to (C), various additives which are used in the conventional hot melt adhesive composition. As such additives, for example an antioxidant, a UV absorber and so on are exemplified from the viewpoints of economy and practical use. These additives may be used alone or in any combination of not less than two.

As the antioxidant, a phenol based antioxidant, a phosphorous based antioxidant, and a sulfur based antioxidant are preferable. A content of the above antioxidant is

preferably in the range between 0.1 and 4% of the total weight of the hot melt adhesive composition, and particularly preferably between 0.3 and 2%.

As the UV absorber, a benzophenone type UV absorber and a benzotriazole type UV absorber such as 2-(2-hydroxy-5-methylphenyl) benzotriazole are preferable. A content of the above UV absorber is preferably between 0.1 and 4% of the total of the hot melt adhesive composition, and particularly preferably between 0.3 and 2%.

The hot melt adhesive composition according to the present invention may be prepared by for example charging the above components into a melting/mixing stirred vessel followed by heating them to a predetermined temperature and mixing.

The disposable article according to the present invention may be produced by bonding together substrates made of a nonwoven fabric, a woven fabric, an elastomer (for example a natural rubber), paper, a polyethylene film and so on using the above hot melt adhesive composition in the conventionally known manner. There is no specific limiation on the above disposable article, and a paper diaper, a sanitary napkin, a hospital gown, a surgical white gown, gauze, a pet sheet and so on may be exemplified as the articles. Among them, the hot melt adhesive composition is preferably used for bonding a natural rubber member in a leg gather portion (elastic portion) of the paper diaper.

There is no specific limitation as to the application manner of the above hot melt adhesive composition, but a melt blow application manner is preferable. That is, when the above hot melt adhesive composition is applied by the melt blow manner, the non-uniform application pattern in the form of the dotted particles of the hot melt adhesive is further improved, the bouncing phenomenon is effectively suppressed, and an excellent bond is provided. As an application apparatus for the melt blowing, a curtain spray coater (produced by SUNTOOL Co.), a slot spray coater (produced by Nordoson Co.), a Dynafiber Coating System (produced by ITW Dyinatec K.K.), and a melt blown coater (produced by J&M Laboratories Co.) may be exemplified.

Examples will be explained hereinafter together with Comparative Examples.

Components shown in the following Tables 1 to 3 below were blended at the indicated ratios, followed by melt-mixing them at around 150°C to prepare aimed hot melt adhesive compositions.

Table 1

| | | (parts by weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Example | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| SBS | styrene 40%, 25% viscosity 650 cps | 15 | 15 | 18 | 10 | --- | --- |
| | styrene 25%, 25% toluene viscosity 1000 cps | --- | --- | --- | --- | 7 | --- |
| | styrene 35%, 25% toluene viscosity 450 cps | --- | --- | --- | --- | 8 | --- |
| SIS (styrene 13%, 25% toluene viscosity 1500 cps) | | --- | --- | --- | --- | --- | 15 |
| SBR | styrene 25%, 25% toluene viscosity 6000 cps | --- | --- | --- | 10 | 7 | 5 |
| | styrene 25%, 25% toluene viscosity 3000 cps | 5 | --- | --- | --- | --- | --- |
| | styrene 45%, 25% toluene viscosity 1500 cps | --- | 5 | --- | --- | --- | --- |
| | styrene 15%, 25% toluene viscosity 80000 cps | --- | --- | 2 | --- | --- | --- |
| liquid SIR (styrene 13%) | | --- | --- | --- | --- | --- | --- |
| tackifier resin *1 | | 60 | 60 | 60 | 60 | 60 | 60 |
| plasticizer (paraffin based oil) *2 | | 20 | 20 | 20 | 15 | 15 | 15 |
| antioxidant | *3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | --- |
| | *4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | --- |
| | *5 | --- | --- | --- | --- | --- | 0.5 |
| UV absorber *6 | | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |

*1: I-marv S100N produced by Idemitsu Petrochemical Co., Ltd.
*2: Diana Process Oil PS-32 produced by Idemitsu Kosan Co., Ltd.
*3: Sumilizer GM produced by Sumitomo Chemical Co., Ltd.
*4: Sumilizer TPD produced by Sumitomo Chemical Co., Ltd.
*5: Sumilizer BP101 produced by Sumitomo Chemical Co., Ltd.
*6: JF77 produced by Johoku Chem. Co. Ltd.

Table 2

| | | (parts by weight) | | |
|---|---|---|---|---|
| | | Example | | |
| | | 7 | 8 | 9 |
| SBS | styrene 40%, 25% toluene viscosity 650 cps | 15 | 15 | 15 |
| | styrene 25%, 25% toluene viscosity 1000 cps | --- | --- | --- |
| | styrene 35%, 25% toluene viscosity 450 cps | --- | --- | --- |
| SIS (styrene 13%, 25% toluene viscosity, 1500 cps) | | --- | --- | --- |
| | styrene 25%, 25% toluene viscosity 6000 cps | --- | --- | --- |
| | styrene 25%, 25% toluene viscosity 3000 cps | --- | --- | --- |
| | styrene 45%, 25% toluene viscosity 1500 cps | --- | --- | --- |
| | styrene 15%, 25% toluene viscosity 80000 cps | --- | --- | --- |
| liquid SIR (styrene 13%) | | 20 | 30 | 35 |
| tackifier resin *1 | | 60 | 55 | 60 |
| plasticizer (paraffin based oil) *2 | | 5 | --- | --- |
| antioxidant | *3 | 0.3 | 0.3 | 0.3 |
| | *4 | 0.3 | 0.3 | 0.3 |
| | *5 | --- | --- | --- |
| UV absorber *6 | | 0.3 | 0.3 | 0.3 |

*1: I-marv 2100N produced by Idemitsu Petrochemical Co., Ltd.
*2: Diana Process Oil PS-32 produced by Idemitsu Kosan Co., Ltd.
*3: Sumilizer GM produced by Sumitomo Chemical Co. Ltd.
*4: Sumilizer TPD produced by Sumitomo Chemical Co. Ltd.
*5: Sumilizer BP101 produced by Sumitomo Chemical Co. Ltd.
*6: JF77 produced by Johoku Chem. Co. Ltd.

Table 3

| | | (parts by weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Comparative Example | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| SBS | styrene 40%, 25% toluene viscosity 650 cps | 20 | --- | --- | 15 | 17 | 15 |
| | styrene 28%, 25% toluene viscosity 850 cps | --- | --- | 25 | --- | --- | --- |
| SEBS (styrene 30%, 25% toluene viscosity, 200 cps) *1 | | --- | 25 | --- | --- | --- | --- |
| BR *2 | | --- | --- | --- | 5 | --- | --- |
| IR *3 | | --- | --- | --- | --- | 3 | --- |
| liquid IR *4 | | --- | --- | --- | --- | --- | 20 |
| tackifer resin *1 | *5 | 60 | --- | 60 | 60 | 60 | 60 |
| | *6 | --- | 65 | --- | --- | --- | --- |
| plasticizer (paraffin based oil) | *7 | 20 | --- | 20 | 20 | 20 | 5 |
| | *8 | --- | 10 | --- | --- | --- | --- |
| antioxidant | *9 | 0.3 | -- | 0.3 | 0.3 | 0.3 | 0.3 |
| | *10 | 0.3 | --- | 0.3 | 0.3 | 0.3 | 0.3 |
| | *11 | --- | 0.5 | --- | --- | --- | --- |
| UV abosorber *12 | | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |

*1: G-1726X produced by Shell Chemical Co. Ltd.
*2: Diene 35F produced by Asahi Chemical Industry Co., Ltd.
*3: Kuraprene IR-10 produced by Kuraray Co., Ltd.
*4: Kuraprene LIR-50 produced by Kuraray Co., Ltd.
*5: I-marv S100 produced by Idemitsu Petrochemical Co., Ltd.
*6: I-marv P100 produced by Idemitsu Petrochemical Co., Ltd.
*7: Diana Process Oil PS-32 produced by Idemitsu Kosan Co., Ltd.
*8: Diana Process Oil PW-90 produced by Idemitsu Kosan Co., Ltd.
*9: Sumilizer GM produced by Sumitomo Chemical Co., Ltd.
*10: Sumilizer TPD produced by Sumitomo Chemical Co., Ltd.
*11: Sumilizer BP101 produced by Sumitomo Chemical Co., Ltd.
*12: JF77 produced by Johoku Chem. Co. Ltd.

Properties of the hot-melt adhesive compositions thus produced in Examples 1 to 9 and Comparative Examples 1 to 6 were estimated according to the following manners, and the results are shown in the following Tables 4 to 6.

Adhesion

A polyester film having a thickness of 50 μm was prepared, on which the hot-melt adhesive composition was coated to have a thickness of 50 μm. A polyethylene film having a thickness of 100 μm was laminated on the composition. Then, a T-type peeling off test was carried out with respect to the laminate under the conditions of a pulling speed of 300 mm/min. and a measurement temperature of 20°C or 40°C, and the adhesion strength was measured. When the adhesion strength was not smaller than 1500 (g/25mm), ⊗ is used; when the strength was in the range between 1000 and 1499 (g/25mm), ⊕ was used; when the strength was in the range between 500 and 999 (g/25 mm), Δ is used; and when the adhesion strength was not larger than 499 (g/25mm), × is used.

Thermal Stability

1. Hue

The hot-melt adhesive composition was allowed at a temperature of 180°C for 72 hours, and then hue of the composition was visibly determined. When the composition was colored white or non-uniformly colored, "separate" is indicated, and its score is marked with ×.

2. Odor

The hot-melt adhesive composition which experienced the same thermal conditions as in the above hue determination was organoleptically estimated as to its odor (the panel members were ten). When there was substantially no odor, ⊕ is used; when there was a little odor, Δ is used; and when there was clearly odor, × is used.

Spraying Attitude

The hot-melt adhesive composition was spray coated onto a substrate (PET film) using a coater (a curtain spray coater produced by Suntool Co. Ltd. having a gun head width of 210 mm, a discharging width of 50 mm, and an air discharging width of 70 mm) at a predetermined temperature (140°C, 150°C or 160°C), and then another substrate (PET film) was laminated thereon. A discharging rate was 5 cc/min., a hot air pressure was 1.0 kg/cm$^2$, and a hot air temperature was 180°C.

1. Particles

Whether or not the hot-melt adhesive composition blown from a nozzle of a coater was deposited on a substrate in the form of particles, namely the presence of the particles was visually observed. When the particles were clearly present, × is used; when a small number of particles were present, Δ is used; when few particles were present ⊕ ~ Δ is used; and when no particle was present, ⊕ is used.

2. Bouncing phenomenon

Whether or not the hot-melt adhesive composition blown from a nozzle of a coater solidified before reaching a substrate in the form of particles so that they were bounced by spraying air, namely the presence of the bouncing phenomenon was visually oberved. When no bouncing phenomenon was observed, ⊕ is used; and when the bouncing phenomenon was observed, × is used.

Adhesion the Natural Rubber

The hot-melt adhesive composition was estimated as to adhesion to a natural rubber which is used for a leg gathering portion (elastic portion) of a paper diaper. That is, the hot-melt adhesive composition was applied onto a commercially available polyethylene film (having a thickness of 30 μm) in a predetermined manner (curtain spray

or spiral spray) to form a film (20 g of the composition per square meter), and then the polyethylene film was laminated onto a natural rubber member (having a thickness of 250 μm). Then, the other side of the rubber member is attached to a commercially available nonwoven fabric to prepare a sample. It is noted that the sample was prepared while the rubber member was extended to a length of 2.5 times of its original length. The sample was fixed onto a corrugated board while the sample was fully extended, and then a length of 200 mm of such sample was cut off. The cut off sample was allowed at a predetermined temperature (normal temperature or 40°C) for 60 minutes, and then its length was measured. When the length was not smaller than 150 mm, ⊗ is used; when the length was in the range between 120 mm and 149 mm, ⊕ is used; when the length was in the range between 100 mm and 119 mm, ∆ is used; and when the length was not larger than 99 mm, × is used.

Overall Estimation

All the properties of the adhesion, the thermal stability, the spray attitude, and the adhesion to the natural rubber were estimated overall, and four grade estimation (⊕, ⊕ ~ ∆, ∆ and ×) was carried out.

Table 4

| | | Example | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| melt viscosity (cps/160°) | | 2500 | 1900 | 2800 | 5000 | 4100 | 3200 |
| adhesion | 20°C | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ |
| | 40°C | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ |
| thermal stability | hue | pale yellow | pale yellow | pale yellow | yellow | pale yellow | pale brown |
| | odor | ⊕ | ⊕ | ⊕ | ⊕~△ | ⊕ | △ |
| spraying attitude | application temperature | 160°C | 140°C | 160°C | 160°C | 160°C | 160°C |
| | particles | ⊕ | △ | ⊕~△ | ⊕ | ⊕ | ⊕ |
| | bouncing | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ |
| adhesion to natural rubber | application method | 160°C curtain spray | 140°C curtain spray | 160°C curtain spray | 160°C curtain spray | 160°C curtain spray | 160°C curtain spray |
| | normal temperature | ⊗ | ⊕ | ⊗ | ⊗ | ⊗ | ⊗ |
| | 40°C | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ | ⊕ |
| overall estimation | | ⊕ | △ | ⊕~△ | ⊕~△ | ⊕ | △ |

Table 5

| | | Example | | |
|---|---|---|---|---|
| | | 7 | 8 | 9 |
| melt viscosity (cps/160°C) | | 3200 | 3700 | 4600 |
| adhesion | 20°C | ⊗ | ⊗ | ⊕ |
| | 40°C (g/25 mm) | ⊕ | △ | △ |
| thermal stability | hue | yellow | yellow | yellow |
| | odor | ⊕ | ⊕ | ⊕ |
| spraying attitude | application temperature | 160°C | 160°C | 160°C |
| | particles | ⊕ | ⊕ | ⊕ |
| | bouncing | ⊕ | ⊕ | ⊕ |
| adhesion to natural rubber | application method | 160°C curtain spray | 160°C curtain spray | 160°C curtain spray |
| | normal temperature | ⊗ | ⊕ | ⊕ |
| | 40°C | ⊕ | △ | △ |
| overall estimation | | ⊕ | △ | △ |

Table 6

| | | Comparative Example | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| melt viscosity (cps/160°C) | | 1600 | 1600 | 3100 | 5530 | 2580 | 3000 |
| adhesion | 20°C | ⊗ | × | ⊕ | --- | --- | --- |
| | 40°C | ⊕ | △ | △ | --- | --- | --- |
| thermal stability | hue | pale yellow | pale yellow | brown × | separate × | separate × | separate × |
| | odor | ⊕ | ⊕ | △ | △ | △ | △ |
| spraying attitude | application temperature | 160°C | 150°C | 160°C | not determined* | not determined* | not determined* |
| | particles | × | × | × | | | |
| | bouncing | ⊕ | ⊕ | ⊕ | | | |
| adhesion to natural rubber | application method | 160°C spiral spray | 150°C curtain spray | 160°C spiral spray | not determined* | not determined* | not determined* |
| | room temperature | ⊕ | × | ⊕ | | | |
| | 40°C | × | × | × | | | |
| overall estimation | | × | × | × | × | × | × |

*In Comparative Examples 4 to 16, the spray attitude and the adhesion to the natural rubber were not estimated because of the estimation of "separate".

It is seen from the above Tables 4 to 6 that the hot-melt adhesive composition of each Example is superior in all the properties of adhesion, thermal stability, spray attitude, and adhesion to natural rubber. To the contrary, the hot-melt adhesive composition of each Comparative Example is inferior in any one of the properties of adhesion, thermal stability, spray attitude, and adhesion to natural rubber.

Effects of the Invention

As described above, the hot-melt adhesive composition according to the present invention contains a thermoplastic rubber (component A), a specific diene based rubber (component B) and a tackifier resin (component C). When the diene based rubber (component B) comprising at least one selected from a styrene-butadiene rubber and one

styrene-isoprene rubber is used with the above thermoplastic rubber (component A), the elasticity of the above thermoplastic rubber (component A) is reduced, so that the formation of the particles is prevented. Further, the hot-melt adhesive composition which contains a tackifier resin (component C) as well as a thermoplastic rubber (component A) and a specific diene based rubber (component B) improves the non-uniform application pattern in the form of dotted particles of the hot-melt adhesive upon the application thereof in the melt blow manner, suppresses the bouncing phenomenon, and also provides the excellent adhesion with respect to the elastomer such as the natural rubber.

Further, when the hot-melt adhesive composition is applied in the melt blow manner, a non-uniform application pattern in the form of dotted particles of the hot-melt adhesive is improved, and the bouncing phenomenon is suppressed.

Also, the disposable article in which the substrates are bonded with the above hot-melt adhesive composition is superior in the adhesion to the conventional disposable article. Particularly, when the composition is used for the paper diaper including the natural rubber member, the adhesion is remarkably improved compared with the conventional paper diaper.

What is claimed:

1. A hot-melt adhesive composition comprising the following components (A) to (C):

(A) a thermoplastic rubber;

(B) a diene based rubber comprising at least one selected from a styrene-butadiene rubber and a styrene-isoprene rubber; and

(C) a tackifier resin.

2. The hot-melt adhesive composition according to claim 1 wherein the composition further comprises a plasticizer.

3. The hot-melt adhesive composition according to claim 1 or 2 wherein the thermoplastic rubber as component (A) is at least one selected from a styrene-butadiene-styrene block copolymer and a styrene-isoprene-styrene block copolymer.

4. The hot-melt adhesive composition according to any one of claims 1 to 3 wherein an amount of the diene based rubber as component (B) is not more than 30% by weight based on a total weight of the hot-melt adhesive composition.

5. The hot-melt adhesive composition according to any one of claims 1 to 4 wherein the diene based rubber as component (B) has a styrene content of not more than 50% by weight of the diene based rubber is not more than 80,000 cps.

6. A method of applying the hot-melt adhesive composition according to any one of claims 1 to 5 characterized in that the composition is applied by melt blow manner.

7. A disposable article comprising at least two different subtrates which are bonded characterized in that the substrates are bonded by the hot-melt adhesive composition according to any one of claims 1 to 5.

8. The disposable article according to claim 8 wherein at least one of the substrates is made of a natural rubber.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C09J153/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 96 11236 A (PALUMBO GIANFRANCO ;BONELLI GUIDO (IT); CORZANI ITALO (IT); PROCTE) 18 April 1996 (1996-04-18) page 27, line 4 - line 5; claims 1,31,32,52,53; example 1 | 1-5,7 |
| A | US 5 624 424 A (TAKAHASHI MIE ET AL) 29 April 1997 (1997-04-29) column 8, lines 38-40 and 51-52 | 6 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
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